



Healthcare data interoperability using Blockchain

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A revolution in health care is underway and it is altering decades of established medical practice. Clinical Health (HITECH) Act of 2009 and Affordable Care Act (ACA) in 2010 have significantly impacted healthcare. In the last 5 years, the healthcare industry has witnessed a significant adoption of Electronic Health Records. This has led to significant advancements in digitizing the care delivery systems in healthcare. Volume-based medical practices that depended on consultations, tests, prescriptions, hospitalization, procedures and medical devices are moving to personalized and participative care with an emphasis on outcome-based models. The good news is that the wealth of available patient data can help achieve these goals by providing physicians and caregivers with unprecedented insights and radically improve care delivery. But the silver lining has a grey cloud: patient data is fragmented across systems and, to further complicate matters, is available in disparate formats. Progress in digitization of care delivery systems has created a growing demand for interoperability that not only supports the care continuum, but also supports healthcare in general. EHR interoperability is a critical and necessary step that needs to be taken by stakeholders for improving healthcare. However, interoperability has remained limited and has many challenges, like lack of healthcare data standards, insufficient privacy laws, cost and trust among the stakeholders.

Defining interoperability

The Healthcare Information and Management Systems Society (HIMSS) has developed a definition of interoperability. As per HIMSS, interoperability has three levels.

- **Foundational** – At this level Health Information Technology (HIT) systems exchange information without any ability to interpret the data.
- **Structural** – This is the middle layer that defines the data formats exchanged between

HIT systems, retaining syntactic meaning of the data.

- **Semantics** – This is the top most layer, where HIT systems send and receive data, interpret data meaningfully using standardized codes.

For real machine-to-machine interoperability of EHR systems, it is important that systems fulfill all the above requirements. In addition to above technical requirements, data privacy is a big concern among healthcare stakeholders; hence, any system supporting interoperability of EHR must support permissions, trust and data security.

Why Blockchain

Blockchain provides the mechanism to anonymize data and ensure the data cannot be tampered with or forged. The Blockchain uses public key cryptography to create records that are time-stamped and immutable. Copies of these data records are stored across thousands of nodes on a digital network. Changing these records at each node becomes an impossible task and prohibitively expensive, making the records reliable. The trust network created in this manner is among the most attractive features of this technology.

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This is particularly important in an environment of growing connected devices, where security and authenticity of data is a matter of concern. In addition, the owner of the data can, via smart contracts, make data from across providers and treatment sites selectively accessible.

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healthcare industry. Primarily, it is the ability of the technology to solve problems of trust, data integrity and anonymization that are of interest to healthcare professionals.

Blockchain does not address the basic technical requirements for interoperability, but provides the foundation for a secure, permissioned framework for data exchange.



Interoperability: secure data sharing

Any technology that can solve the problem of interoperability in a secure manner has the potential to become a game changer. This is the potential of Blockchain technology. Not surprisingly, it is generating an inordinate amount of interest in the industry. While

organizations like Health Level Seven International (HL7) continue to provide standards for data exchange like Fast Healthcare Interoperability Resources (FHIR), Blockchain could provide the right interventions. (See Table 1: Potential impact of Blockchain on healthcare).

Potential impact of Blockchain on healthcare



Different data standard and non-standard API for accessing patient data.



Blockchain does not solve the data standardization issue, but provides a platform for sharing data in real-time on a trusted network.

Patients have limited access to their own health records and data is rarely leveraged across providers.



Blockchain can potentially provide access to patient data in a secure manner among trusted players in the network.

Permission issues in accessing the right information at the right time from various sources.



Smart contract can potentially solve data access issue, providing access to right information at the right time.

Uniform identity issues across care givers.



Public and private key pair as used in Blockchain can potentially solve the identity issue.

Lack of meaningful use of data in EHR for research and innovation.



Availability of anonymized data on Blockchain for mining.

Two aspects of Blockchain technology are of interest to the healthcare industry: Permissioned Blockchains and Smart Contracts. A Permissioned Blockchain maintains the privacy of the data and makes the data accessible to actors on the network who are authorized to access it. Smart Contracts are 'instructions' on the Blockchain that are executed automatically once all the necessary conditions or events are met. This means data can be made available automatically, without human intervention.

All the elements required for successful deployment of Blockchains in healthcare already exist: EHR data, FHIR and HL7 that can guide the standardization of APIs to make the data available to everyone in the ecosystem; and Smart Contracts ensure data reaches the right stakeholders and authorized entities at the right time.

Change agent: multiple benefits

The benefits of making EHR more effective by using Blockchain are irrefutable. It will lead to

personalized and participative treatment along with outcome-based models; it will help researchers create better products at lower costs; it will help in faster and more accurate verification of claims data and improve settlements; it will reduce fraud; and it will help meet regulatory compliance.

These are positives that are difficult to ignore. However, there is little incentive today for caregivers and other stakeholders to share information. This is because the industry is still aiming for volumes – more patients, more consultations, more tests, more procedures and more hospitalization. When the balance shifts to outcome-based fees, there will be incentive to access patient records – it is then that interoperability will become a compelling proposition and Blockchain will be the sought-after solution. Already, there is growing consensus that the challenges faced by healthcare can only be addressed by changing the business model. Which means that Blockchain becoming an integral part of the healthcare industry is not far away.

About the author

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He comes with 20+ years of experience in semiconductors, medical devices and scientific instruments. His focus in the recent past has been connectivity and interoperability in medical devices. Vijay's work includes developing connectivity

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